Space Weather Technical Forecast

Issued on Sunday, 07 July 2024 at 01:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with an M1.0 flare coming from the southeast of the disc at 07/2315 UTC. There are nine sunspot regions on the disc. AR3738 in the southeast is now the largest region, with some magnetic complexity becoming apparent. There are signs it might have a couple of small delta spots, but this is difficult to assess due to foreshortening near the limb. AR3733 in the northwest is now the second largest region, and is getting harder to assess as it approaches the limb. AR3729 has developed a weak trailing spot, whilst AR3740 has only small spots but does have a slightly complex magnetic structure. All other groups appear small and simple at present. No Earth-directed Coronal Mass Ejections (CMEs) have been observed during the past 24 hours.
Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were at background levels. Wind speeds varied between 320-370 km/s. The density remained mostly below average. The Interplanetary Magnetic Field, Bt, was weak at 7nT or below. The north-south component, Bz, varied weakly between +6/-4 nT. The phi angle was predominately positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-2).
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 remained at background levels. The 24-hour fluence was below Active, with 2.16e6 integrated pfu observed at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of further M-class flares, with a slight chance of X-flares, most likely from AR3738. Upcoming sunspot regions arriving over the eastern solar horizon should help compensate for regions rotating off the west limb.
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs feature in the forecast. The solar wind is most likely to be at slow-ambient levels for much of this period. However, CH49/+ in the northwest could give slightly elevated wind speeds on Day 1 into Day 2 (07-08 Jul), but with low confidence. CH51/- currently near south centre disc could then produce slightly elevated or elevated wind speeds later in the period, perhaps later on Day 4 (10 Jul). However, any significant geomagnetic response is unlikely due to Earth's proximity to the solstice.
Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp 0-3) through the next four days, however there is a chance of the odd Active (Kp 4) interval both on Day 1 and perhaps more so on Day 4 due to potential fast wind influence.
Energetic Particles / Solar Radiation: Solar radiation storms are unlikely, but with a slight chance of reaching S1/Minor Radiation Storm or greater levels. This risk increases a little as AR3738 currently in the southeast rotates towards centre disc.
High energy electron flux is expected to remain mostly at background levels through this period, with Active (1e8 integrated pfu) fluence not expected.

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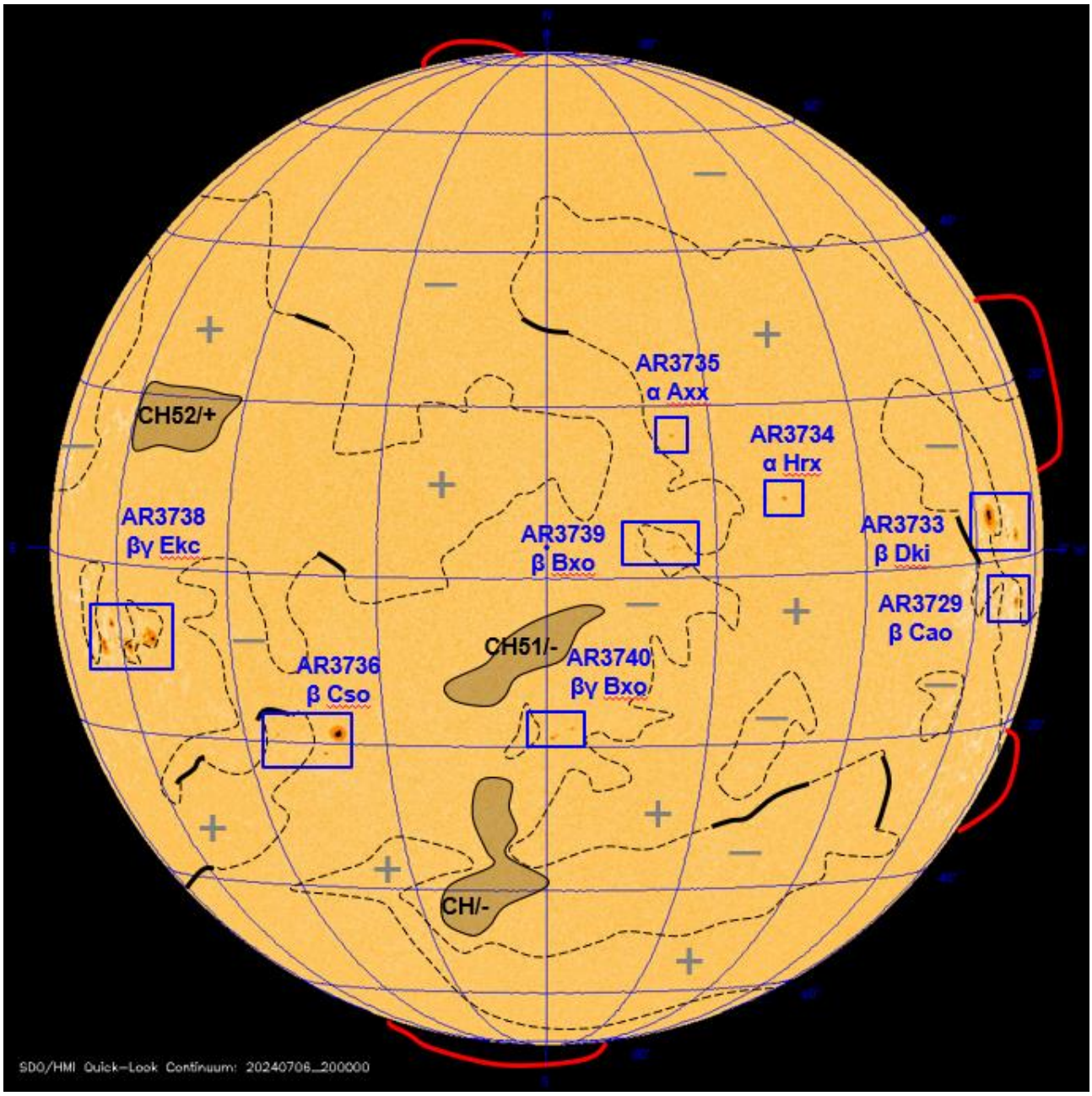
Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs feature in the forecast.

In the expected absence of any CME arrivals, the solar wind is most likely to be at slow-ambient levels for much of this period. However, there is a coronal hole (CH49/+ in the northwest), which has been closing up in EUV imagery (e.g. AIA211) as it crosses the disc. Even with this trend, the potentially Earth-affecting solar wind from CH49/+ may have departed prior to this occurring, and as such slightly elevated wind speeds are possible on Day 1 into Day 2 (07-08 Jul), but with low confidence. Following this a coronal hole near centre disc in the south (CH51/-) could produce slightly elevated or elevated wind speeds later in the period, perhaps later on Day 4 (10 Jul). This is a larger coronal hole than the previous rotation when there was no influence from this feature, closer to the solar equator, so it could bring fast winds this time around. However, any significant geomagnetic response is unlikely due to Earth's proximity to the solstice.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp 0-3) through the next four days, however there is a chance of the odd Active (Kp 4) interval both on Day 1 and perhaps more so on Day 4 due to potential fast wind influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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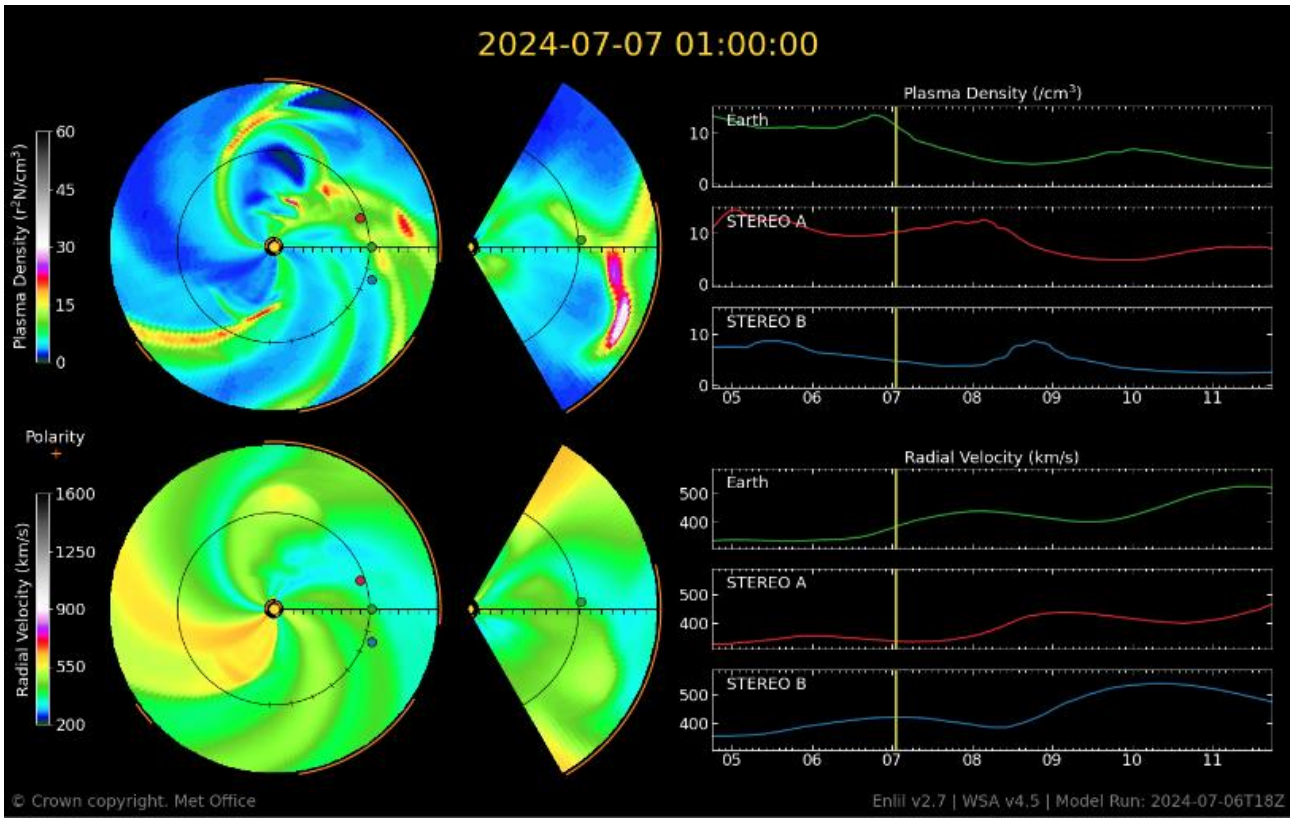
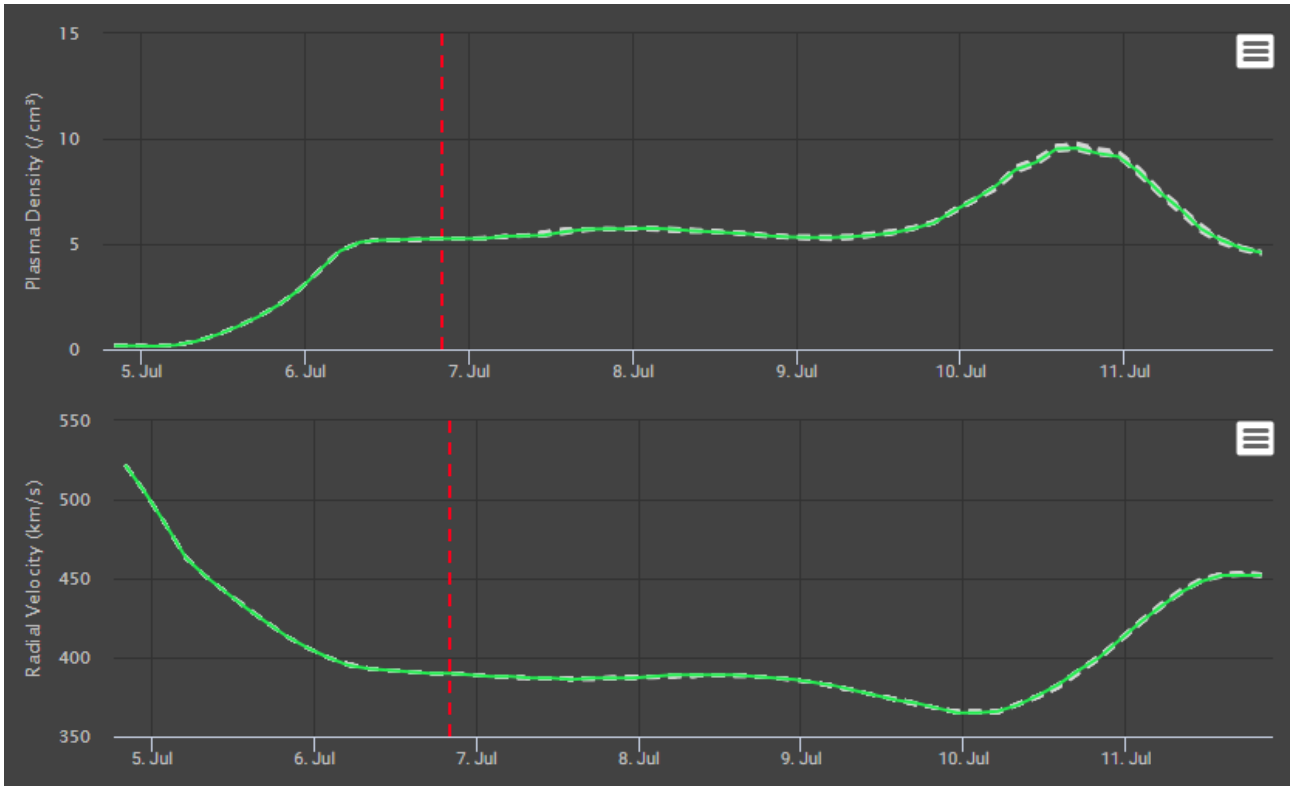
Figure 2: MOSWOC Enlil and ensemble showing no Earth directed CMEs, but a slight increase in wind speed on Day 1 (07 Jul) and a greater increase on Day 4 (10 Jul), in line with the coronal hole forecast.





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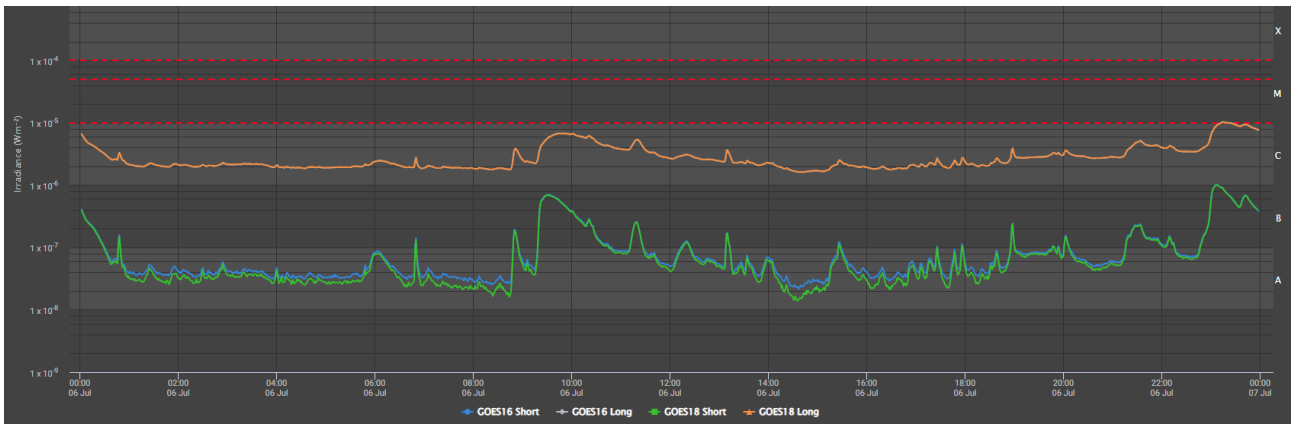
Radio Blackouts - X-Ray Flares:
Solar activity has been Moderate with an M1.0 flare coming from the southeast of the disc at 07/2315 UTC. There are nine sunspot regions on the disc. AR3738 (Ekc/Beta-Gamma) in the southeast is now the largest region, with some magnetic complexity becoming apparent. There are signs it might have a couple of small delta spots, but this is difficult to assess due to foreshortening near the limb. AR3733 (Dki/Beta) in the northwest is now the second largest region, and is getting harder to assess as it approaches the limb. AR3729 (Cao/Beta) has developed a weak trailing spot, whilst AR3740 (Bxo/Beta-Gamma) has only small spots but does have a slightly complex magnetic structure. All other groups appear small and simple at present.

The main flare risk is from AR3738, with a chance of further M-flares and a very slight chance of isolated X-flares. AR3733 rotates off the disc during Day 2 (08 Jul), perhaps dropping the flare risk a touch. However, looping in EUV imagery and far side seismographs suggest more regions to rotate on, likely balancing this loss.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	Yes	50	50	50	50
Very Active	**R3 to R5 X Class**	No	5	5	5	5

Figure 3: X-ray flux at GOES16 and 18, showing a recent low level M-flare which originated from either AR3738 or just over the southeast limb.



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux at GOES18 has been at background levels. It is most likely to remain that way, but with a slight chance of exceeding the S1/Minor radiation storm threshold, should any larger flares occur from the west of the disc. The main risk of larger flaring is from AR3738 in the southeast, but as this region rotates more towards centre disc by Day 4 (10 Jul), the probability of exceeding S1 increases a little.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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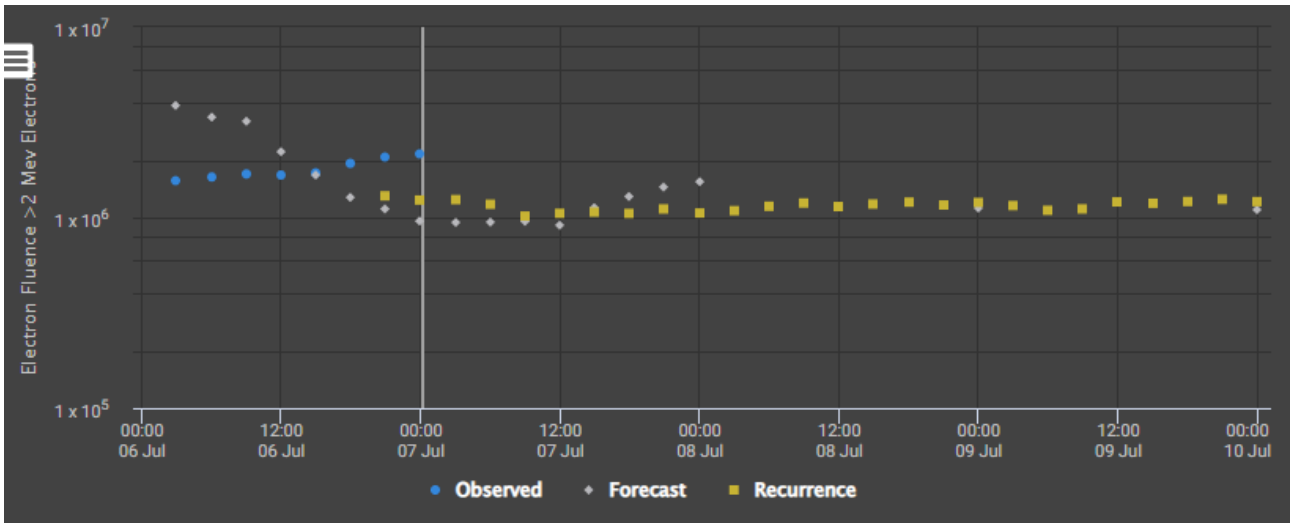
High Energy Electrons Event (≥ 2MeV):
High energy electron flux recorded at GOES16 has been at background levels and is likely to remain that way through the coming four days. Any fast wind influence from CH49/+, should it occur, is likely to be limited and therefore is not expected to drive any significant increase in electron flux. A more likely fast wind from CH51/- is not expected until Day 4 (10 Jul), with any response to this feature not expected until after the end of this period.

The MOSWOC REFM output is considered good guidance, with a generally flat trend indicated through the guidance period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a well below Active forecast.



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